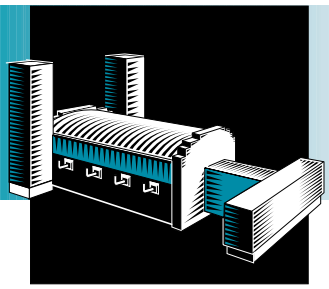
GLASS
Project Fact Sheet



Enabling Tool for Innovative Glass Applications

Benefits

- Produces sharp-edged, angular particles from glass that are applicable as abrasive waterjet media at approximately 1% the price of garnet
- Improves glass manufacturing versatility and design flexibility by making abrasive waterjet cutting more economical
- Allows glass particle cutting-waste stream to be reclaimed for use as a plastic filler, reducing waste
- Extends abrasive waterjet technology with glass abrasive to cut a variety of materials, including aluminum, polymers, wood, and glass
- Provides an outlet for mixed glass waste from recycling operations

Applications

The new technology applies to the production of flat glass products. Use of waste glass makes abrasive waterjet cutting economical for many types of glass design and installation, increasing versatility in glass fabrication. In addition, the cutting-waste stream of fine, rounded glass particles becomes a marketable by-product, suitable for use as plastic filler. Glass as an abrasive can also be used with AWJ technology to cut a variety of industrial materials other than glass.

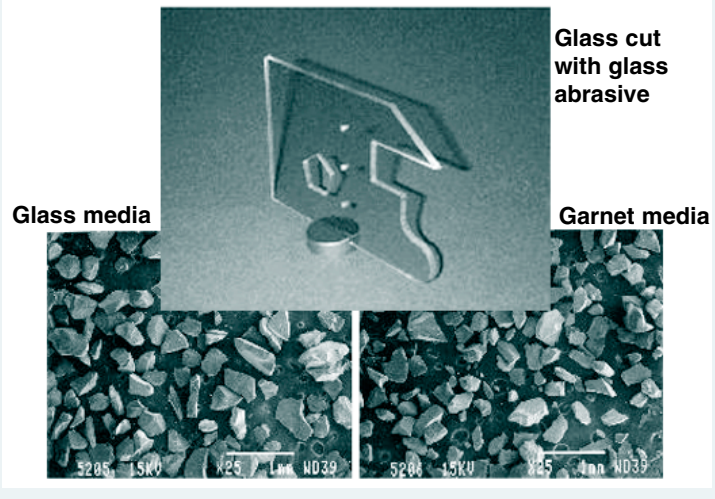
Processed glass provides an economically superior material for use in abrasive waterjet cutting systems

Flat architectural and automotive glasses have traditionally been fabricated using scoring and flame-breakout fracturing technologies. These processes have inherent cutting limitations because they are generally incapable of fabricating glass products with small radii, concave edges, or pierced holes. These restrictions limit design and installation options for glass products.

However, these restrictions can be mitigated with the use of an abrasive waterjet (AWJ) cutting technique, which uses a stream of water carrying an abrasive material to erode the surface being cut. This technique allows the machining of hard and brittle materials, results in minimal heat build-up and deformation stresses, and allows greater flexibility in the machining of parts. Garnet abrasive media have proven to be the best performers in AWJ cutting, yet their expense has limited the use of AWJ cutting systems in the industrial sector to applications that are difficult to machine using conventional means.

A new technology employs waste glass as a new, low-cost abrasive media for AWJ cutting of glass and other materials. In addition, using glass to cut glass results in a homogenous waste stream that allows the glass particles to be reclaimed for use as a plastic filler. If the glass media is of sufficient quality, it could be recycled into the molten glass.

Using Waste Glass for Cutting



Traditionally, garnet abrasive media have been used in abrasive waterjet (AWJ) cutting of glass, but their expense has hindered widespread use. A new use of waste glass in AWJ cuttings yields similar results to garnet abrasive media with less cost.

OFFICE OF INDUSTRIAL TECHNOLOGIES
ENERGY EFFICIENCY AND RENEWABLE ENERGY • U.S. DEPARTMENT OF ENERGY

Project Description

Goal: Develop abrasive waterjet cutting systems, using glass as the abrasive media, for fabrication of new and existing glass products.

The abrasive waterjet cutting technique uses a stream of water with an entrained abrasive to cut materials. The most frequently used abrasives are silicates, particularly the garnet group. Glass is also a silicate, but in a non-crystalline form, eliminating concern for silicosis. Glass exhibits physical properties comparable to those of garnet, although its hardness is slightly less. When properly processed, glass has the same size and shape characteristics as garnet and appears to be a technically equivalent, economically superior media for use in AWJ machining.

Reducing the cost of AWJ processing for glass could allow a wider variety of glass products to be produced, as AWJ can eliminate many existing design limitations for glass. In addition, when glass is used to cut glass, the resulting waste stream of fine, rounded glass particles can be reclaimed as a marketable by-product, which is usable as a filler with various polymers or recyclable back into the process.

Michigan Technological University is developing this new technology with the help of a grant funded by the Inventions and Innovation Program in the Department of Energy's Office of Industrial Technologies.

Progress and Milestones

- Develop a process to produce glass media through method testing and particle characterization.
- Test AWJ cutting with glass media to assess parameters and cutting performance.
- Characterize cutting and abrasive waste from AWJ cutting of plate glass.
- Evaluate glass particle waste as a filler in polymers used for injection molding.

Economics and Commercial Potential

The potential for cost savings and increased fabricating versatility for innovative glass applications with this tool is substantial. Garnet abrasives currently used in abrasive waterjet cutting cost $.34 to $.42 per pound, while waste glass media is estimated to cost approximately $.0035 per pound, a savings factor of 100. With the cost of garnet representing approximately 35 percent of AWJ operating costs, there is substantial savings potential in the overall cost of operation.

Installing an AWJ system requires little modification of existing glass-cutting systems that use gantry-style robots. At the same time, the AWJ system eliminates the inherent thermal stresses and exhaust requirements of the flame-breakout systems currently used in the manufacture of auto glass. Eliminating burners and makeup air requirements reduces fuel bills and CO_2 emissions. Meanwhile, the waste-glass abrasive makes the AWJ cutting system economical for use in production of a variety of intricately shaped and innovative new glass products. In addition, the abrasive waterjet approach shows promise in its ability to machine other industrial materials, such as metals and ceramics.

Using waste glass as an abrasive media also strengthens the market for crushed glass. This strategy uses either mixed glass from recycling operations or a processed waste stream from within a glass facility.

Industry of the Future—Glass

In April 1996, several organizations representing the glass industry signed a compact with the Department of Energy (DOE) in an effort to encourage technological innovations that will reduce energy consumption, pollution, and production costs in the industry. The glass industry published a report entitled ***Glass: A Clear Vision for a Bright Future,*** *which articulated the industry's vision of its future. This compact set the foundation for collaborative efforts between the industry and the Federal government. Signed by both key industry players and Department of Energy officials, it was a formal commitment to align DOE'S limited resources to meet the challenges identified in the vision.*

OIT Glass Industry Team Leader: Elliott Levine (202) 586-1476.

The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and conduct early development. Ideas that have significant energy savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

For project information, contact:

Mr. J. M. Gillis
Institute of Materials Processing
Michigan Technological University
1400 Townsend Drive
Houghton, MI 49931-1295
Phone: (906) 487-1820
Fax: (906) 487-2921
jmgillis@mtu.edu
Home Page:
www.imp.mtu.edu

For program Information contact:

Lisa Barnett
Program Manager
Inventions and Innovation Program
U.S. Department of Energy
1000 Independence Ave., SW
Washington, DC 20585-0121
Phone: (202) 586-2212
Fax: (202) 586-7114
lisa.barnett@ee.doe.gov

For project updates,
visit our home page at
www.oit.doe.gov/inventions

Office of Industrial Technologies
Energy Efficiency
and Renewable Energy
U.S. Department of Energy
Washington, DC 20585-0121

Order# I-GL-767
October 2001